UNIVERSITI PUTRA MALAYSIA

FACTORS INFLUENCING INFORMATION COMMUNICATION TECHNOLOGY UTILIZATION AMONG STUDENT TEACHERS OF MALAYSIAN RESEARCH UNIVERSITIES

HASSAN MIRZAJANI

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By

HASSAN MIRZAJANI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree of Doctor of Philosophy

January 2017

DEDICATION

This Thesis is dedicated to

My Lovely Wife, Dear Mehraneh, Without Whose Caring Support It Would Not Have Been Possible.

And

Dedicated to My Honorable Father and Kindhearted Mother Whose Ceaseless Prayers and Encouragement Paved My Way Towards Enlightenment and Wisdom. My joy and Comfort Today is Due to Their Past Efforts Done Yesterday.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the Degree of Doctor of Philosophy

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Chairman : Associate Professor Rosnaini Mahmud, PhD
Faculty : Educational Studies

The purpose of this correlational study is to investigate the extent of ICT utilization and its relationship with ICT attributes, perceived usefulness, perceived ease of use, attitudes toward ICT use, and facilitating conditions among student teachers in Malaysian Research Universities. It also sought to determine the availability of the conditions that facilitate ICT utilization among student teachers. In addition, the study determined whether perceived usefulness, perceived ease of use, attitudes toward the use of ICT, ICT attributes and facilitating conditions are predictors of ICT utilization among student teachers.

The data were collected from the target population of student teachers in RU1, RU2, RU3, RU4, and RU5 (N = 3565). A stratified random sample of 349 student teachers were selected and a set of questionnaires were distributed. The reliability testing yielded an acceptable internal consistency of .79. Descriptive statistics were employed to describe and summarize the attributes of the data collected from respondents. Pearson's Product Moment coefficient was conducted to determine the relationship between individual independent variables of the study and the extent of ICT utilization by student teachers. In addition, multiple regression was used to predict the value of a dependent variable (ICT utilization) based on the value of independent variables.

The findings of the study indicated that the level of ICT utilization among student teachers was moderate, suggesting they were not using ICT as it should be. The findings revealed that the main use of ICT by student teachers was limited to typing assignments, PowerPoint presentations, doing online search, e-mailing, and chatting with friends. This result indicated that most student teachers use ICT as a productivity tool to complete simple tasks.Results of data analysis revealed that student teachers' perceptions varied across the five ICT attributes. Their responses were positive about

the relative advantage of ICT and were negative about the complexity of ICT. The results of the study indicated that there was a significant relationship between ICT attributes (r = .22), and facilitating conditions (r = .33), and ICT utilization by student teachers. In addition, perceived usefulness (B=.1954, $p < 0.05$), and perceived ease of use (B=.3005, $p < 0.05$) has a significant effect on attitude toward use of ICT.

The findings of the present study showed that all eight facilitating conditions were present in the Malaysian Research Universities. Conditions "Commitment by those who are Involved" (M = 3.79, SD = 0.57), "Knowledge and Skill Exist" (M = 3.73, SD = 0.46), "Resources are Available" (M = 3.64, SD = 0.50), "Time is Available" (M = 3.63, SD = 0.57), and "Leadership is Evident" (M = 3.56, SD = 0.55), were found to have highest presence in the Malaysian Research Universities. The study results also revealed that variables namely attitude toward ICT use (β = .33, p <.05), knowledge and skill (β =.25, $p < .05$), and resources (β =.21, $p < .05$) were found to be significant predictors of ICT utilization by student teachers.

The study concludes that the level of ICT utilization among student teachers was moderate. It is recommended that the university administration should take actions such as provide an appropriate support for academics and training course and required resources to support the use of educational technology among student teachers. It is also recommended that future research should involve large sample and include more variables such as subjective norm, level of self-efficacy, intentions to use and other related variables to measure ICT utilization among student teachers in Malaysia.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysis
sebagai memenuhi keperluan untuk Ijazah Doktor Falsafah

FAKTOR YANG MEMPENGARUHI PENGGUNAAN TEKNOLOGI MAKLUMAT DAN KOMUNIKASI DALAM KALANGAN GURU PELATIH DI UNIVERSITI PENYELIDIKAN MALAYSIA

Oleh

HASSAN MIRZAJANI

Januari 2017

Pengerusi : Profesor Madya Rosnaini Mahmud, PhD
Fakulti : Pengajian Pendidikan

Tujuan kajian korelasi ini adalah untuk menyiasat sejauh mana penggunaan ICT dan hubungannya dengan sifat-sifat ICT, jangkaan kegunaan, jangkaan kemudahan penggunaan, sikap terhadap penggunaan ICT, dan kondisi memudahkan dalam kalangan guru pelatih di Universiti Penyelidikan Malaysia. Ia juga bertujuan untuk menentukan adanya kondisi yang memudahkan penggunaan ICT dalam kalangan guru pelatih. Di samping itu, kajian ini menentukan sama ada jangkaan kegunaan, jangkaan kemudahan penggunaan, sikap terhadap penggunaan ICT, ciri-ciri ICT, dan kondisi memudahkan adalah peramal penggunaan ICT dalam kalangan guru pelatih.

Data telah dikumpulkan daripada populasi sasaran guru pelatih di RU1, RU2, RU3, RU4, and RU5 (N = 3565). Satu sampel rawak berstrata melibatkan 349 guru pelatih telah dipilih dan satu set soal selidik telah diedarkan. Ujian kebolehpercayaan menghasilkan konsistensi dalaman yang boleh diterima iaitu .79. Statistik deskriptif digunakan untuk menerangkan dan merumuskan sifat-sifat data yang diperoleh daripada responden. Ujian pekali Pearson product moment dilaksanakan untuk menentukan hubungan antara pemboleh ubah bebas kajian dan tahap penggunaan ICT oleh guru pelatih. Juga, regresi berganda digunakan untuk meramalkan nilai pemboleh ubah bersandar (penggunaan ICT) berdasarkan nilai pemboleh ubah bebas.

Dapatan kajian menunjukkan bahawa tahap penggunaan ICT dalam kalangan guru pelatih adalah sederhana, yang menunjukkan mereka tidak menggunakan ICT seperti yang diharapkan. Dapatan menunjukkan bahawa penggunaan utama ICT oleh guru pelatih adalah terhad kepada menaip tugasan, persembahan PowerPoint, melakukan carian dalam talian, e-mel, dan berbual dengan rakan-rakan. Keputusan ini menunjukkan bahawa kebanyakan guru pelatih menggunakan ICT sebagai alat produktiviti untuk menyelesaikan tugas-tugas yang mudah.Keputusan analisis data

menunjukkan bahawa persepsi guru pelatih berbeza merentasi seluruh lima sifat ICT. Respon mereka yang paling positif adalah mengenai kelebihan relatif ICT dan paling negatif tentang kerumitan ICT. Hasil kajian menunjukkan bahawa terdapat hubungan yang signifikan antara sifat-sifat ICT (r = .22), dan kondisi memudahkan (r = .33), dan penggunaan ICT oleh guru pelatih. Sebagai tambahan jangkaan kegunaan (B=.1954, p < 0.05) dan jangkaan kemudahan penggunaan (B= .3005, p < 0.05) mempunyai kesan yang ketara pada sikap terhadap penggunaan ICTDapatan kajian ini menunjukkan semua lapan kondisi mempermudahkan terdapat dalam universiti-universiti penyelidikan Malaysia. Kondisi "Komitmen oleh Mereka yang Terlibat" (M = 3.79, SD = 0.57), "Pengetahuan dan Kemahiran Wujud" (M = 3.73, SD = 0.46), "Sumber-sumber ada Tersedia" (M = 3.64, SD = 0.50), "Masa adalah Tersedia" (M = 3.63, SD = 0.57), dan "Kepemimpinan adalah Terserlah" (M = 3.56, SD = 0.55), didapati wujud dalam universiti-universiti penyelidikan Malaysia. Dapatan kajian ini menunjukkan bahawa kesemua lapan kondisi wujud tetapi pada pelbagai darjah. Hasil kajian juga menunjukkan bahawa pemboleh ubah sikap terhadap penggunaan ICT (β = 0.33, p < .05), pengetahuan dan kemahiran (β = .25, p <.05), dan sumber (β = .21, p <.05) didapati menjadi peramal signifikan penggunaan ICT oleh guru pelatih.

Secara kesimpulannya, tahap penggunaan ICT dalam kalangan guru pelatih adalah sederhana. Berdasarkan hasil kajian, adalah dicadangkan supaya pihak pengurusan universiti perlu mengambil tindakan seperti memberikan sokongan yang diperlukan oleh para pensyarah dan menyediakan kursus latihan dan memerlukan sumber untuk menyokong penggunaan teknologi pendidikan di kalangan guru pelatih. Adalah dicadangkan juga supaya kajian akan datang dapat melibatkan lebih ramai responden dan mengkaji lebih banyak faktor-faktor dari norma subjektif, tahap keberkesanan diri, niat untuk menggunakan dan faktor lain untuk mengukur penggunaan ICT di kalangan guru pelatih di Malaysia.

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I certify that a Thesis Examination Committee has met on 24 January 2017 to conduct the final examination of Hassan Mirzajani on his thesis entitled "Factors Influencing Information Communication Technology Utilization among Student Teachers of Malaysian Research Universities" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

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Declaration by graduate student

I hereby confirm that:

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This is to confirm that:

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LIST OF ABBREVIATIONS

HEI	Higher Education Institutions
ICT	Information and Communication Technology
DIT	Diffusion of Innovations Theory
LMS	Learning Management System
MOOC	Massive Open Online Courses
MOE	Ministers of Education
PU	Perceived Usefulness
PEU	Perceived Ease of Use
SEAMEO	South East Asia Ministers of Education Organization
TAM	Theory of Technology Acceptance Model
UNESCO	United Nations Educational, Scientific and Cultural Organization
VLE	Virtual Learning Environments
ITU	CT Utilization

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Globalization and rapid changes in technology have created a new economy, which is driven by knowledge. In conjunction with this, Information and Communications Technology (ICT) is now undoubtedly the critical enabler of a knowledge-based economy for many nations (Noor-Ul-Amin, 2013). ICT can be used to discover, present, develop, resolve issues, and explain information. ICT are electronic technologies used for information retrieval and storage. Sen (2016) defined ICT as the combination of informatics technology with other related technologies, specifically communication technology. Governments across the globe have recognized the positive impact ICT has on social and economic development. Consequently, many governments have started to invest heavily in ICT to develop the nation's human capital to address the demands of the digital and information age (Wong, Goh, & Rahmat, 2013).

In the early 1980s, ICT was introduced as an innovation that could be used in universities and schools, and it was speculated that this new trend would change the face of education with high impacts upon teaching and learning (Hong & Songan, 2011). Furthermore, ICT could enhance the quality of education by helping teachers accomplish their duty in line with enhancing of students' learning efficiency (Chai, 2010). ICT utilization in education has increasingly become an important concern in education in developed and developing countries (Agyei & Voogt, 2011). Many nations have allocated huge budgets for ICT utilization in education, defined developed programs, ICT standards, and put ICT courses in teaching and learning education programs, as well as educate student teachers on ICT use for learning (Tezci, 2011; Usun, 2009; Wong et al., 2013).

Policymakers widely accept that access to ICT in education can help individuals to compete in a global economy by creating a skilled work force (Oluoch, Onunga, & Onditi, 2015). ICT utilization in education has a multiplier effect throughout the education system, by enhancing learning and providing students with new sets of skills, by reaching students with poor or no access (especially those in rural and remote regions) by facilitating and improving teachers training, and by minimizing costs associated with the delivery of traditional instruction (UNESCO, 2014).

In this era, ICT provides different opportunities for schools and universities in order to improve their educational systems to meet students' needs and prepare the new generation for challenges of tomorrow's world (Hernandez et al., 2011). ICT assists students in managing knowledge, which is especially vital for student teachers. Besides that, ICT offer benefits such as monitoring progress, providing for "anytime anywhere" learning, enabling independent and collaborative learning, and developing

new modes of learning (Davies, Hayward, & Lukman, 2007). Furthermore, through ICT use, student teachers will be able to share their resources and experiences and adopt the good practice for further teaching (Biasutti & Heba, 2012). It has also been acknowledged that if student teachers were to be equipped to compete in the global information society, education has to be transformed and the use of ICT in the teaching and learning process should be included (Fook, Sidhu, Kamar, & Abdul Aziz, 2011).

In the technological trends of the 21st century, all member countries of the South East Asia Ministers of Education Organization (SEAMEO), including Malaysia, have begun to focus on the benefits of ICT to improve teaching and learning. In line with Vision 2020, which is also known as 'Wawasan 2020', which was launched in 1991 during the tabling of the Sixth Malaysia Plan by the fourth Prime Minster of Malaysia, Tun Dr. Mahathir bin Mohamad, Malaysia has embarked on several technology initiatives to spearhead ICT utilization particularly at the turn of the 21st century for rapid economic growth and development, with the vision of becoming a developed nation by 2020 (Mahmud & Ismail, 2010). The Malaysian Ministry of Education believes that ICT utilization in teaching and learning as well as in managing educational institutes and administrative areas are the prerequisites for making Malaysia a high-income country (Ministry of Education, 2015).

1.2 ICT Utilization in Malaysian Higher Education

Technology use is constantly evolving and becoming more important in the workplace and our lives (Teo, Lee, & Chai, 2008). Utilization of ICT for learning refers to a variety of learning experiences that use technology to support and enhance learning (Noor-Ul-Amin, 2013). It is commonly referred to the intentional use of ICT. It includes online learning, virtual learning, distributed learning, network and web-based learning, and is used to portray any type of learning environment that is a computer enhanced learning experience, which takes place away from the actual classroom (Woldab, 2014).

Studies have shown ICT use can enrich students' learning by increasing student achievement, students' academic performance, and enhancing student motivation (Akuegwu, Ntukidem, & Jaja, 2011) improving higher order thinking skills (Lincoln, 2009), engagement, and job preparation, and improving students' abilities to work collaboratively (Hernández & Goodson, 2006). Therefore, learning approaches using contemporary education technology tools provide many opportunities for constructivist learning through their provision and support for resource-based, student-centered settings and by enabling learning to be related to context and to practice (Hernandez, Montaner, Sese, & Urquizu, 2011).

In this information age, the Malaysian higher education system, as in other developing countries, has a clear vision that ICT can transform conventional education systems and bring advantages and benefits to the country as a whole, especially for the younger generation (Wong, Goh, Hafizl, & Rosma, 2010). In line with this vison, the Malaysian higher education system has grown from strength to strength over the past

few decades. Over the last ten years, the system has made significant gains in student enrolment, attained global recognition on key dimensions such as research publications, patents, and institutional quality, as well as becoming a top destination for international students (Ministry of Education, 2015).

The domains of teaching and learning are experiencing changes as Higher Education Institutions rapidly accept the practices and concepts of Virtual Learning Environments (VLE) (Brown, 2010). Many universities these days are starting to offer web-based courses to supplement and complement traditional classroom-based courses. ICT utilization provide students with different benefits such as flexibility, convenience, and the opportunity to work closely and collaboratively with lecturers and other learners from different universities or even across the world (Hung, Chou, Chen, & Own, 2010). ICT utilization enhanced the student's learning experience that many universities implemented using a set of teaching and learning tools such as computers and the internet in the learning process (Ahmed, Zakaria, & Elmi, 2014).

Under the Ministry of Higher Education (MoHE) in 2006, four of Malaysia's oldest and state - controlled universities were chosen to receive the recognition as research universities to generate intellectual capital, new knowledge and advance technology. The four research universities are Universiti Malaya (UM), Universiti Sains Malaysia (USM), Universiti Kebangsaan Malaysia (UKM), and Universiti Putra Malaysia (UPM) (Ho-Abdullah & Yahaya, 2007). Later in 2010, Universiti Teknologi Malaysia (UTM) was chosen as a fifth research university.

The Malaysian Research Universities have been established to develop human capital or highly trained knowledge workers to support the knowledge economy (Singh, Zain, & Jamil, 2011). These research universities are expected to "generate intellectual capital, new knowledge and innovative technology" (MoE, 2004, p. 4). According to the Ministry of Education, (2012) Malaysian student teachers are expected to master ICT integration in the learning process, and they will be educated on alternative learning approaches and assessments such as project-based learning and ICT-based assessments. The Ministry of Education, in order to achieve its set goals, formulated three policy objectives for its ICT plan in education. They are to reduce the digital divide between the haves and the have-nots in the country and enable ICT access for all students, to use ICT as a teaching and learning tool in education and taught as an independent subject and integrated into others and lastly, to use ICT to enhance efficiency, effectiveness and productivity of management in education (Ministry of Education, 2012). For example, in September 2014, the Ministry launched for the first year undergraduate common compulsory courses offered by Universiti Putra Malaysia (UPM), Universiti Kebangsaan Malaysia (UKM), Universiti Malaysia Sarawak (UNIMAS), and Universiti Teknologi MARA (UiTM) using the Massive Open Online Courses (MOOCs) concept (Ministry of Education, 2015). It can therefore be concluded that implementation strategies were designed to use ICT which has been implemented in the Malaysian education system in order to prepare appropriate ICT equipment for higher education, upgrading the ICT skills and knowledge of both teachers and students, increasing ICT use in educational management and upgrading maintenance in educational institutions (Ministry of Education, 2012).

While Malaysian stakeholders in education expect a high level of technology adoption in the classrooms, there is also a growing concern that in spite of growing number of technologies and level of educational technology, the levels of ICT utilization among Malaysian student teachers were often low (Raman, 2014; Singh & Subramaniam, 2014; Wong et al., 2013; Wong et al., 2012). This reluctance to use ICT has been the case despite the evident realization of the potential of using ICT in various institutions of higher education in Malaysia. Several researchers identified some of the primary reasons that seem to prevent ICT utilization by Malaysian student teachers. For instance, Teo et al. (2008) demonstrated perceived usefulness, perceived ease of use, and computer attitudes, to be significant determinants of both Singaporean and Malaysian student teachers' behavioral intention to use technology. In another research, Wong et al. (2013) investigated student teachers' behavioral intention to utilize ICT and found that perceived usefulness is a significant influence on student teachers' attitude towards computer use.

Fook et al. (2011) investigated using ICT for learning by student teachers in the Malaysia. The findings highlighted the lack of facilities and technical malfunction in schools as the biggest obstacle for the student teachers in their efforts to integrate ICT in the classroom. Baleghi-Zadeh, Ayub, Mahmud, and Daud (2014) conducted a study on the utilization of Learning Management System (LMS) among student teachers in the Malaysian Research Universities. The findings of the study revealed that student teachers do not fully use the Learning Management System. In addition, the result of the study suggested a model which explores the effect of three constructs of perceived ease of use, perceived usefulness, and subjective norm on behavior intention to utilization of learning management system. Furthermore, Raman (2014) stated that student teachers in a Malaysian public university have low-level awareness about using ICT. He suggested that this is likely due to the lack of facilities available to the students. In another study, Luan and Teo (2011) investigated acceptance of computer technology among Malaysian student teachers. The study found perceived ease of use, perceived usefulness, of computer technology, and attitude towards computer use to be important determinants of intentions to utilize computers among student teachers. In relation to this study, several research works have been conducted in other counties. For example, Woldab (2014) investigated the factors affecting successful implementation of e-learning among Ethiopian student teachers. He found that the teachers' utilization of e-learning dependent on four key factors, namely ICT infrastructure, ICT leadership, support and training initiatives and the teachers' and trainees' ability.

The factors aforementioned as well as others identified by several researchers appear to prevent the use ICT by student teachers. Nawawi (2005) stated that another way to look at technology implementation in higher education is to ask what conditions would facilitate faculty members' implementation of technology in instruction. Therefore, the present study looks into what factors and conditions will be facilitating student teachers' ICT utilization in Malaysian Research universities?

In an attempt to address the issues, Ely's conditions of change (1990,1999) and Davis' (1989) Technology Acceptance Model (TAM) were adopted in this study as they suggest a series of conditions that facilitate the use of educational technologies, which in the context of this study is ICT utilization. In addition, Diffusion of Innovations Theory (DIT) introduced by Rogers (2003) are considered valuable to the usage of new tools because how the characteristics of the ICT are perceived and acceptance by student teachers will impact on the ICT utilization process.

Ely's (1990a) condition of change seeks to identify the conditions fostering ICT utilization by users. Ely (1990a) suggested eight conditions that should exist or be created in the environment where the innovation is implemented to facilitate utilization of educational innovations in a variety of educational-related contents especially higher education. According to Teo (2010), facilitating conditions refers to the factors present in the environment that bring to bear and impact on a person's desire to perform a task. These conditions are therefore the focus of this study. Furthermore, Diffusion of Innovations Theory(DIT) (Rogers, 2003) is one of the theories investigating the factors that affect utilization of an innovation. According to Rogers (2003) "an innovation is an idea, practice or object that is perceived as new by an individual or another unit of adoption" (p. 12). Another relevant model in this study is Technology Acceptance Model (TAM), introduced by Davis (1986). This model indicated that when users are offered a new technology, a number of factors influence their decision about how and when to use the new technology that includes: attitude towards usage, perceived usefulness and perceived ease-of-use (Davis, 1986).

Undoubtedly, the appropriate use of ICT is very important to provide opportunities for student teachers to learn and operate in the information age. It requires student teachers to transform their learning by incorporating ICT into their lessons. This shift requires investigation into various factors and conditions for the successful ICT utilization by student teachers. This is because they can contribute to understanding the relationships between predicting factors and ICT utilization by student teachers.

1.3 Statement of the Problem

The current generation of student teachers tends to be savvy with social and communications technologies (Luan & Teo, 2011). The Ministry of Education in Malaysia has introduced educational technologies (e.g., E-Learning, Virtual Learning Environment (VLE), Massive Open Online Courses (MOOCs), Learning Management System (LMS), and Online learning) to promote a wider ICT use in schools and universities aimed at enhancing students' learning (Ministry of Education, 2015). Despite the large expenditure of funds invested, human resources and infrastructure building to facilitate the ICT utilization in higher education, however, studies show using educational technology among student teachers is limited and do not use educational technology to its fullest potential in the universities. For example, Raman and Don (2013) investigated LMS utilization among 188 student teachers in Universiti Utara Malaysia (UUM) and found student teachers were reluctant to use communication features such as chatting and messaging facilities. Sulaiman (2013) investigated the process of learning through educational technologies among 102

student science teachers and undergraduate science physics students in University Malaysia Sabah (UMS) and found students had obstacles and deficiencies in using educational technology in the program of problem-based learning. Islam (2013) investigated ICT utilization among 249 higher education students and found most of the students use ICT for downloading course material and submitting their assignments.

The existing literature has emphasized on teacher technology preparation as the most important step in the effective use of new technologies and successful ICT integration into the education system. For this purpose, student teachers need to acquire educational technology competencies such as the knowledge of ICT, attitude and use of ICT. All student teachers need to be familiar with educational technologies and competent in the use of ICT applications before they start their career as a teacher. If teachers are expected to use educational technologies into the school curriculum, preparations must be made at the student teacher education level. It is also very important to look at the ICT utilization among student teachers because the literature indicated that ICT utilization among student teachers is limited (Raman & Mohamed, 2013; Umar & Hassan, 2015).

Although the rate of ICT use in universities is growing, ICT is often used for basic technologies including e-mail, word processing, presentation tools, but users in universities were unfamiliar with more advanced educational technology tools (Raman, 2014). In fact, the findings of several studies indicate that levels of ICT utilization among student teachers were often low. For example, Raman (2014) reported that although student teachers in a Malaysian public university generally possessed good educational technology skills to use word processors and presentation software, are able to access and use email and the internet, they have a low-level capability in using applications such as 'web group' discussions, website design web 2.0, multimedia, and digital video editing. He concluded that this is likely due to the lack of facilities available to the student teachers, or the universities are not properly equipped for ICT application in the classroom. Raman and Don (2013) investigated LMS utilization among 188 student teachers in Universiti Utara Malaysia (UUM) and found that student teachers not willing to use LMS. They indicated that this may be due to less suitability in educational settings and other variables such as time of access.

One of the popular and powerful models in studying factors affecting utilization of ICT is Technology Acceptance Model (TAM) (Igbaria et al., 1995; Venkatesh & Bala, 2008). Based on TAM, using ICT by individuals depends on two key variables of perceived ease of use (PEOU) and perceived usefulness (PU) (Davis et el., 1989). Davis (1993) also found that perceived usefulness and attitude significantly have direct effect on system usage. Individuals are expected to utilize the system when they form positive attitudes (Bajaj & Nidumolu, 1998). Therefore, in the domain of education, student teachers should perceive the usefulness of technological tools in supporting learning activities and achieving academic goals. On the other hand, educational technology should be free of efforts (Davis et al., 1989). The results of several previous studies revealed that both perceived usefulness and perceived ease of use had a significant effect on ICT utilization (Teo, Lee, & Chai, 2008; Teo & Schaik,

2012; Wong et al., 2013). Users' attitude toward ICT use is another variable in TAM which acts as a bridge between perceived ease of use and perceived usefulness and ICT use (Davis et al., 1989). Several studies that indicate that attitude toward ICT has a significant effect on ICT utilization (Agut, Lozano, & Peris, 2014; Teo, 2008). Gulbahar (2008b) found a significant correlation between student teachers' experiences with ICT, their attitudes toward ICT, and their confidence in using ICT in the classroom.

The TAM has been used numerously in the past and most recent studies to investigate acceptance of technology and extended to include other constructs (Cheung & Huang, 2005; Drennan, Kennedy, & Pisarski, 2005; Tung & Chang, 2007; Wu, Wang, & Lin, 2007). Studies concerned with technology acceptance problems in education which are grounded on this model have focused on different subjects including accounting, graphics, mainframe applications, and the internet. A study by Teo et al. (2008) investigated the factors affecting technology acceptance among Singaporean and Malaysian pre-service teachers. Asgari and Zarghan (2011) describe the TAM as a close-fisted, theoretical, and empirical validated model predetermined to explain the acceptance of Information Systems. Thus, the TAM supports robustly this study which investigates the antecedents that are related to instructional ICT utilization among the student teachers. The TAM was used as a guide and basis of this research as it is one of the popular and well supported models in information technology studies (Shiue, 2007). Therefore, the TAM was used as the theoretical foundation of this study to perceive a clearer design on how technologies are accepted in the education system, especially on the predictors that influence the use of ICT among student teachers.

Although the TAM was developed to investigate adoption decisions across a wide range of organizational environment and user populations, there are limited research studies on it being applied in an educational environment. Latter studies have been of user acceptance of computer technology among pre-service teachers. Ma, Andersson, and Streith (2005) study employed the TAM to investigate 84 students. The findings revealed that one factor for the difference between teachers and the general ICT users was that teachers were comparatively independent and have sizable exclusive control over their instructional activities, including technology use and choices. Hu, Clerk, and Ma (2003) posited that the reason business organizations have basically different objectives compared to educational institutions was because teachers on the whole experience less peer pressure in promotions and resources. In addition, studies concerned with technology acceptance problems in education which are grounded on this model have focused on different subjects including accounting, graphics, mainframe applications, and the internet. A study by Teo et al. (2008) investigated the factors affecting technology acceptance among Singaporean and Malaysian pre-service teachers. Asgari and Zarghan (2011) describe the TAM as a close-fisted, theoretical, and empirical validated model predetermined to explain the acceptance of Information Systems. The TAM deals directly with problems related to the implementation of new technology. The model is easy and simple to apply to many and any situation, and this is its strength. Therefore, the TAM, Ely's eight conditions of change and ICT attributes supports this study which seeks to determine factors that are related to ICT usage among student teachers.

The attributes of ICT, as perceived by the users, determine the rate of ICT utilization. In other words, when ICT "is perceived by users as having greater relative advantage, compatibility, trialability, observability, and less complexity, the innovation will be adopted more rapidly" (Askar, Usluel, & Mumcu, 2006, p. 142). There are several studies indicate that ICT attributes can be considered as a factor affecting ICT utilization (Albirini, 2006; Cleveland, 2014; Sahin, 2012). For instance, Teo (2009) investigated the predicted level of ICT acceptance among student teachers. The findings indicated that technological complexity has a negative effect on perceived usefulness of ICT. Furthermore, Askar et al. (2006) indicated that if ICT has a high degree of observability, it would be relatively easy for the user to learn about it and judge its potential advantage. Alhawiti (2011) examined the faculty perceptions of intention and obstacles affecting diffusion of online programs at two universities in Saudi Arabia. The findings revealed that relative advantage was a most an important attribute and that it was the key obstacle preventing faculty members from using online programs.

Facilitating conditions, which includes giving facility to users, plays an important role in ICT utilization. When users receive no help from the assistants while being faced with a problem, then they will get the feeling that working with the system is a waste of time and hence they will quit working with it (Sánchez & Hueros, 2010). The past studies conducted by Arouri (2013), Dogra and Thakur (2013), Goktas, Yildirim, and Yildirim (2009), Luan and Teo (2009) and Liu (2012) have found that without adequate technology tools, knowledge and skills, technical support, technology availability, and sufficient training student teachers have little opportunity to utilize ICT. For example, Fook et al. (2011) examined Malaysian student teachers' attitudes, preparation, and skills in ICT utilization in their teaching and learning activities. They found that while student teachers intended to use ICT technologies for learning, they (student teachers) lacked facilities, and technical knowledge for handling malfunctions and expertise needed to use ICT effectively in their classrooms. They also claimed that more ICT-related training or courses should be conducted for pre-service and in-service teachers. While facilitating conditions is one of the important factors that may affect ICT utilization, there is a paucity of empirical research that has investigated its influence on ICT use (Singh & Subramaniam, 2014).

Although a number of studies have explored factors that influence student teachers' utilization of various educational technologies including computers (Luan & Teo, 2011; Teo, 2009), web2.0 (Raman, 2014), Learning Management System (Baleghi-Zadeh et al., 2014) and Mobile Learning (Darren Pullen et al., 2015) little research has been conducted that examines the potential factors and conditions that determine student teachers' utilization of other aspects of ICT such as the internet application, VLE, online portal, Facebook for learning, blog, and online resources in a classroom. In addition, past studies used a limited number of variables and small number of participants. Moreover, in the context of Malaysia, a few studies have combined facilitating conditions, ICT attributes and student teachers' attitude towards ICT use to examine whether these factors can predict student teachers' ICT utilization. For this reason, there is a need for research to be done in Malaysia to investigate factors influencing information communication technology (ICT) utilization among student teachers of Malaysian Research Universities.

1.4 Objectives of the Study

The purpose of the present study was to determine the factors that contribute ICT utilization among student teachers in Malaysian Research Universities. Therefore, the study was conducted to achieve the following objectives:

1. To determine the level of ICT utilization among student teachers in Malaysian Research Universities.
2. To determine the ICT attributes, perceived usefulness, perceived ease of use, attitude toward ICT use, and facilitating conditions among student teachers in Malaysian Research Universities.
3. To determine the relationship between ICT attributes and facilitating conditions, with ICT utilization by student teachers in the Malaysian Research Universities.
4. To determine the factors that contribute ICT utilization among student teachers in Malaysian Research Universities.
5. To explain the role mediator (attitude toward use of ICT) for ICT utilization among student teachers in Malaysian Research Universities.

1.5 Research Questions

Based on the objectives of this study, the research questions and hypotheses were formulated to guide the study.

Objective 1

1. What is the level of ICT utilization among student teachers in Malaysian Research Universities?

Objective 2

2. What are the ICT attributes perceived by the student teachers in Malaysian Research Universities?
3. What are student teachers' perceived usefulness towards ICT use?
4. What are student teachers' perceived ease of use towards ICT use?
5. What are student teachers' attitudes towards ICT use?
6. What are the conditions that are present or not present in facilitating the use of ICT amongst student teachers in Malaysian Research Universities?

1.6 Hypotheses of the Study

Objective 3

H_1: There is a significant relationship between relative advantage and ICT utilization by student teachers in the Malaysian Research Universities.

H_2: There is a significant relationship between compatibility and ICT utilization by student teachers in the Malaysian Research Universities.

H_3: There is a significant relationship between trialability and ICT utilization by student teachers in the Malaysian Research Universities.

H_4: There is a significant relationship between observability and ICT utilization by student teachers in the Malaysian Research Universities.

H_5: There is a significant relationship between complexity and ICT utilization by student teachers in the Malaysian Research Universities.

H_6: There is a significant relationship between dissatisfaction with the status quo and ICT utilization by student teachers in the Malaysian Research Universities.

H_7: There is a significant relationship between knowledge and skills and ICT utilization by student teachers in the Malaysian Research Universities.

H_8: There is a significant relationship between resources and ICT utilization by student teachers in the Malaysian Research Universities.

H_9: There is a significant relationship between time and ICT utilization by student teachers in the Malaysian Research Universities.

H_{10}: There is a significant relationship between rewards or incentives and ICT utilization by student teachers in the Malaysian Research Universities.

H_{11}: There is a significant relationship between participation and ICT utilization by student teachers in the Malaysian Research Universities.

H_{12}: There is a significant relationship between leadership and ICT utilization by student teachers in the Malaysian Research Universities.

H_{13}: There is a significant relationship between commitment and ICT utilization by student teachers in the Malaysian Research Universities.

Objective 4

H_{14}: ICT attributes, perceived usefulness, perceived ease of use, attitude toward the use of ICT, and facilitating conditions contribute the student teachers' ICT utilization in the Malaysian Research Universities.

Objective 5

H_{15}: Attitude toward use of ICT mediates the effect of perceived usefulness on ICT utilization among student teachers.

H_{16}: Attitude toward use of ICT mediates the effect of perceived ease of use on ICT utilization among student teachers.

1.7 Significance of the Study

There are several rational and important reasons for conducting this study. Indeed, nowadays universities are relying on using technology and innovation to support instruction in the current educational system. Higher education is responsible for enhancing the quality of learning and human performance (Chang, 2008). Today, one of the important purposes of higher education is supporting the process of teaching and learning with updated information through Information Technology (Stantchev, Colomo, Soto, & Misra, 2014). The findings of this study will contribute significantly to existing knowledge on ICT utilization by student teachers in the Malaysian Research Universities. This study will be useful in identifying the presence or non-

presence of facilitating conditions and factors that contribute ICT utilization and integration among student teachers. As such stakeholders, might be aware and be informed on the status of ICT use and the possible barriers to use it.

This research also will be providing comprehensive information to the researchers in generating more research concerning the student utilization ICT for learning, so it is expected to add to the literature concerning the current usage of ICT among student teachers. This study, therefore, is important because it will serve as a guide and form the literature for reference materials for future researchers in related areas that may examine ICT utilization among other universities' students in similar educational contexts. Furthermore, the findings of the present study also will lead to awareness of important factors and conditions that facilitate or impede student teachers' ICT use in a classroom environment. Such findings will help teacher educators understand the influences that student teachers encounter beyond the university classroom. Thus, teacher educators will be able to craft courses, programs, and experiences that take these factors into consideration and better prepare student teachers to teach with ICT.

Based on the findings of this study, decision makers will take the necessary steps by removing the obstacles, fostering the positive factors and design training programs to improve ICT use among student teachers. This study will be useful in identifying the presence or absence of facilitating conditions and factors that contribute ICT use and integration in the university classroom. As such, stakeholders might be aware and be informed on the status of ICT use and the possible barriers to employing ICT in learning. Therefore, this study is important because it will be supportive in making effective planning and funding decisions regarding the future investment on ICT in universities by governments.

Finally, it is hoped that the findings of this research will benefit the education system and enable the university administrative leadership to identify the predictor factors that facilitate ICT use among student teachers. Consequently, this research can be useful for the future development of the education system in Malaysia in order to maximize the positive impacts of ICT on the learning environment and reinforce existing pedagogical practices as well as to change the way teachers and students interact.

1.8 Limitations of Study

This study is limited to the ICT utilization among Malaysian student teachers. Furthermore, data from the existing study were derive from the Faculty of Education in Malaysian Research Universities and may not be generalized to the faculty at private universities. Four Malaysian Research Universities have a Faculty of Education Universiti Teknologi Malaysia (UTM), Universiti Malaya (UM), Universiti Kebangsaan Malaysia (UKM), Universiti Sains Malaysia (USM), and only Universiti Putra Malaysia (UPM) has a Faculty of Educational Studies. The population of the present study was limited to undergraduate students of Malaysian Research Universities because these universities have the long history of training student

teachers in higher education (Awang, Abdul Rahman, & Mohd Said, 2004). Furthermore, the findings of this study may not be generalized to all Malaysian public universities because not all universities have faculties of education.

The participants of the present study were full-time undergraduate students whose background, experience, and lifestyle may have been different from the part-time students. Furthermore, the information gathered from the participants were based on their perceptions. Hence, this research needs to be acknowledged and accepted as being based on the accuracy of the data and honesty of the respondents. This study gathered data via survey, which relied on self-reported information. Therefore, the study was not able to assume that participants report their perceptions accurately. Nonetheless, to enhance the honesty of the respondents, the researcher had clarified in the questionnaire that there would be no right or wrong answers and the importance of honesty in the responses to the investigation. As such, the accuracy of data obtained depended on how accurately and honestly the participants answered the questions. Thus, the findings and conclusion of the study are limited to the extent that this method yields accurate and honest responses.

Data from this study were obtained from the student teachers, who are studying in the Faculty of Education in Malaysian Research Universities, thus the findings may not be generalized to student teachers who are training in the Institutes of Teacher Education and students of other faculties. Therefore, the generalization of this study can only be applied to the populations having similar characteristics with the sample of this study and need consideration when applied in other circumstances.

1.9 Definition of Terms

Every important term used in this study is conceptually and operationally defined. This is because clearly defined key terms can help the researcher in data collection, data analysis, and generalizability of the research findings.

Information and Communication Technology (ICT)

ICT is defined as applications that support the educational objectives based on the needs of the current knowledge society (Drent & Meelissen, 2008). Sen (2016) defined ICT as the combination of informatics technology with other related technologies, specifically communication technology. In this study, ICT is defined as all technologies encompassing: the Internet, intranet, Microsoft Word, Excel, PowerPoint, e-journals, multimedia, computer and network, hardware and software, electronic mail, and the World Wide Web as well as the various services and applications associated with them.

ICT Utilization

ICT utilization refers to how often students use ICT for learning (Song & Kang, 2012). According to Yusuf (2005) ICT utilization is the presentation and distribution of instructional content through web environment (e-teaching) or systems offering an integrated range of tools to support learning and communication. In this study, ICT utilization is measured in terms of the frequency of use, it measures the utilization of transforming information tools (downloading course materials, lecturer notes, sending assignments, taking quizzes, calendar and events, report progress, etc.) and communication tools. Student teachers' ICT utilization was measured using a questionnaire developed by Tezci (2011), and Dawson (2008), and adapted for this study. The scale consists of 15 items.

Student Teachers

A student teacher is a student at the postsecondary level pursuing a degree in education for the purposes of pursuing a teaching career (Pennock & Moyers, 2012). In this study, the student teacher refers to the target population and only includes individuals who are at the student-teaching phase of their educational program, and has not yet been certified as a teacher.

ICT Attributes

According to Askar, Usluel, and Mumcu (2006) ICT attributes are defined as certain characteristics that influence an individual or organization to either adopt or reject it. In this study, ICT attributes refer to the characteristics of ICT that affect the rate at which ICT used by student teachers. ICT attributes were measured using a questionnaire developed by Ntemana and Olatokun (2012) and adapted for this study. The scale consists of 23 items of five/four statements that represents each of the five attributes. The five ICT attributes are stated and defined as follows:

Relative Advantage: Lee, Hsieh, and Hsu (2011) defined relative advantage as the degree to which ICT is considered as being better than the idea it replaced. Rogers (2003) defined relative advantage as "the degree to which an innovation is perceived as being better than the idea it supersedes" (p. 229). In this study, relative advantage refers to the degree to which student teachers perceived that the ICT tools in education are better than the previous ICT tools, and perceived a certain attribute of ICT is better than the attributes of similar existing products or services.

Complexity: Complexity refers to the level of difficulty that the potential adopters encounter with the ICT (Brown, 2008). Rogers (2003) defined complexity as "the degree to which an innovation is perceived as relatively difficult to understand and use" (p. 16). In this study, complexity refers to the degree to which student teachers believe that understanding and use of ICT is difficult.

Compatibility: Ntemana and Olatokun (2012) defined compatibility as the degree to which ICT is congruent and similar with existing understandings of similar or past ideas, products, or practices. In this study, compatibility refers to the degree to which ICT in education is perceived by student teacher as being consistent with their past experiences, existing values, and needs.

Trialability: According to Ntemana and Olatokun (2012), trialability refers to a students' access to ICT for experimentation before adoption and use. In this study, trialability refers to the extent to which ICT in education can be tried and tested by the student teacher.

Observability: Observability defined by Sahin (2012) as the degree to which the results of ICT are visible to others. Rogers (2003), defined observability as "the degree to which the results of an innovation is visible to others" (p. 16). In this study, observability refers to the ease with which ICT in education benefits or attributes can be observed, and described by student teacher.

Perceived Usefulness

Perceived usefulness is defined as "the degree to which a person believes that using a particular technology will enhance his or her job performance" (Davis, 1989, p. 320). In this study, perceived usefulness refers to the degree to which student teachers believe that using ICT would enhance their learning performance. Perceived usefulness is measured by a questionnaire developed by Davis (1989) and adapted for this study. The scale consists of 10 items.

Perceived Ease of Use

Perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free from the effort" (Davis, 1989, p. 320). According to In this study, perceived ease of use refers to the extent to which the student teachers believe that using ICT will be free from complexity or great effort. In addition, perceived ease of use of ICT is measured by a questionnaire developed by Davis (1989) and adapted for this study. The scale consists of 10 items.

Attitude towards the Use of ICT

Attitude is defined as an individual's degree to respond in a favorable manner with respect to a psychological object (Ajzen & Fishbein, 2000). Ajzen (2000) defind attitude as an individual's degree to respond in a favorable or unfavorable manner with respect to a psychological object. In the present study, attitude toward ICT use is operationally defined as the mixture of belief, thoughts, and feeling of the student teachers in using ICT in the favorable and unfavorable way. Attitude toward ICT use is measured by a questionnaire developed by Albirini (2006) and adapted for this

study. The scale consists of 15 items divided into three components of the affective, cognitive and behavioral.

Facilitating Conditions

Ely (1999) uses the term conditions of change to refer to a set of facilitating conditions that describe the setting in which a new plan is introduced. In the context of this study, the facilitating conditions in the implementation of utilization of ICT refer to the amount of the presence and absence of the Ely' eight conditions in the Malaysian Research Universities. Facilitating conditions for ICT use will be measured using a questionnaire developed by Nawawi (2005) from Ely's condition of change, and adapted for this study. The scale consists of 40 items of five statements that represents each of the eight conditions. Ely's eight conditions of change are stated and defined as follows:

Dissatisfaction with the Status Quo: Chikwa (2012) defines dissatisfaction with the status quo as "an emotional discomfort resulting from the use of current processes or technologies that are perceived as inefficient, ineffective or not competitive" (p. 20). In this study, dissatisfaction with status quo refers to the degree to which the feeling of dissatisfaction among student teachers over the source of information for their learning process and the general learning environment and expressed needs for improvement.

Resources: Ely (1990, 1999) refers to accessibility and availability of the resources needed to implement innovation. In this study, resources refer to availability and accessibility of relevant materials, tools, facilities, and equipment (computers, handheld devices, printers, laptop, internet access e-resources, etc.) needed by student teachers to use ICT.

Knowledge and Skills: According to Ely (1990), knowledge and skills are what users should possess and/or acquire. According to Prescott (2013), existence of knowledge and skills refers to individuals possessing and acquiring the skills and knowledge needed to use the ICT. In this study, knowledge and skills refer to relevant knowledge and skills student teachers possess to use ICT.

Availability of Time: Availability of time refers to the "willingness of organizations to provide time for users to learn the new skills or procedure in order to use the innovation, as well as the user's willingness to devote time to developing these new skills" (Chikwa, 2012. p.21). In this study, time refers to the student teachers' readiness to commit to the time needed to adapt the ICT utilization.

Rewards or Incentives: Ely (1999) identified incentive as something serving as an expectation for a reward or punishment, and reward of something given for a job well done. In this study, rewards or incentives refer to the appropriate motivation student teachers experience in using ICT.

Participation: According to Ely (1990), participation is the degree of collaboration the administrators have in the decision-making process to adopt and utilization ICT. In this study, participation refers to the degree to which the student teachers' effort, ideas, and opinion affect in the decision process of ICT utilization.

Leadership: Leadership refers to the level of possession and assistance given by the administrators who will direct the daily activities of those using ICT (Bradshaw, 2010). In this study, leadership refers to supporting, answering questions, providing information, and managing daily university activities of ICT as used by student teachers.

Commitment: According to Ely (1990), commitment refers to "noticeable," support by the senior supervisors and leaders. In this study, commitment refers to the student teachers' perception of continuing support for the ICT utilization from generally anyone involved and affected including supervisors, dean of faculty, and deputy deans.

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